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freely used follows. Attention is next turned to the theory of dilute solutions, disperse systems, some additional elements, the periodic classification, and radio-activity.

In the discussion of the topics noted many chemical facts are brought before the student but stress is laid on principles and little space devoted to facts of general interest unless they serve as examples of these principles. For example, the only reference to the preparation of iron from its ores is a paragraph on carbon as a reducing agent, in which the statement is made that metallic iron is made from the mineral hematite by reduction with coke at white heat.

The book is clearly written. It will be of interest to teachers to see how rather difficult subjects can be handled effectively in a simple manner. It will be looked upon with favor as a text for beginners by those who desire to teach facts only through the use of laws and theories and do not think it advisable to unduly emphasize the applications of the science.

JAMES F. NORRIS

NOTES ON METEOROLOGY AND CLIMATOLOGY

RAINFALL INTERCEPTION BY TREES AND CROPS

FOR several years Mr. Robert E. Horton, consulting hydraulic engineer, Voorheesville, N. Y., has carried on investigations of the various aspects of rainfall in relation to run-off.[1] In such studies what the hydraulic engineer needs to know first is how much rainfall reaches the ground, over a watershed. Is it the amount of precipitation that as shown by well-exposed gages?[2] No. Much rain and snow is intercepted by trees, and evaporated. Thus the hydraulic engineer, unlike the meteorologist, needs to study the catches of rain-gages under trees as well as in the open. [Some cooperative observers seem to have anticipated this need.] Mr. Horton has made a careful study of the amount of precipitation which falls through different kinds of trees and of that portion of the intercepted rainfall which runs down the trunks. Also, in order to enable him to form an estimate of the water which reaches the ground over a varied watershed he has determined the amount of rainfall intercepted by different growing crops in various stages. The results of his investigations have been published in the *Monthly Weather Review*.[3]

Mr. Horton concludes that

> Rainfall interception represents a loss of precipitation which would otherwise be available to the soil. The loss takes place through evaporative processes, but may, for convenience be subdivided into (*a*) interception storage, and (*b*) evaporation during rain.
>
> The amount of interception loss is primarily a function of the storage capacity of the plant surface, the duration of precipitation, and the evaporation rate during precipitation. Since there is generally a fairly close correlation between shower duration and amount of precipitation, estimates of interception loss can, for practical purposes, be expressed in terms of precipitation amount per shower.
>
> The interception storage loss for trees varies from 0.02 to 0.07 inch per shower, and approaches these values for well-developed crops. . . . The . . . loss is greater in light than in heavy showers, ranging from nearly 100 per cent. where the total rainfall does not exceed the interception storage capacity to about 25 per cent. as an average constant rate for most trees in heavy rains of long duration. [Of this] the amount of water reaching the ground by running down the trunks of trees . . . is . . . commonly 1 to 5 per cent. of the total precipitation. The percentage increases from zero in light showers to a maximum constant percentage in heavy showers of long duration. Light showers are much more frequent than heavy ones, and the interception loss for a given precipitation in a month or season varies largely according to the rainfall distribution.

[1] See "Additional Meteorological Data Needed by Engineers," by R. E. Horton, *Engineering News Record*, March 27, 1919, pp. 614–616; reprinted in *Monthly Weather Review*, May, 1919, Vol. 47, pp. 305–307.

[2] See "The Measurement of Rainfall and Snow," by R. E. Horton, *Jour. New England Water Works Assoc.*, 1919, Vol. 33, pp. 14–71, 21 figs., 12 tables; reviewed in *Monthly Weather Rev.*, May, 1919, Vol. 47, pp. 294–296.

[3] September, 1919, Vol. 47, pp. 603–623, 17 figs.

Expressing the interception loss in terms of depth on the horizontal projected area shadowed by the vegetation, the loss per shower of a given amount is very nearly the same for various broad-leaved trees during the summer season. . . . The interception loss from needle-leaved trees, such as pines and hemlocks, is greater both as regards interception storage and evaporation during rain than from broad-leaved trees.

Data are insufficient for a final determination of the relative losses from trees in winter and in summer. Apparently the winter and summer losses for a given monthly precipitation for needle-leaved trees the winter interception loss appears to be about 50 per cent. as great when the trees are defoliated as during the growing season. The average interception loss from 11 trees . . . during the summer of 1918 was 40 per cent. of the precipitation.

ATMOSPHERIC MOISTURE IN THE UNITED STATES

Three years ago, Mr. P. C. Day, chief of the climatological division of the Weather Bureau, published a monograph on "Relative humidities and vapor pressures over the United States, including a discussion of data from recording hair hygrometers,"[4] and to which recently Mr. W. J. Bennett, of Tampa, Florida, has added an interesting discussion of tables prepared along similar lines for Tampa.[5] The diurnal changes in *relative humidity* (which is the water vapor present in the air divided by the maximum which would be possible at the temperature) are practically the opposite of the temperature changes, there being a change generally of 3 to 4 per cent. for each change of 1° C. in temperature.

Vapor pressure (the pressure exerted by the water vapor locally in the air) is a direct index of the *absolute humidity* (water vapor per unit volume of space). In summer in dry climates, such as at Boise, Idaho, the vapor pressure rises during the few hours immediately after sunrise as the moisture from the surface (*e. g.*, dew) is evaporated. Then after about 10 A.M. the vapor pressure decreases as convectional currents reach higher and higher and mix the lower air with the drier air above until the principal minimum is reached at about 6 P.M. After this, evaporation, even though small is able to raise the vapor pressure in the absence of convection. In a moderately humid climate, such as that of Columbus, Ohio, the maximum in summer comes at about 10, as in the drier region, but the minimum is not reached until sunrise, when cooling has condensed a maximum of the water vapor. In a marine climate, using San Francisco as typical, the vapor pressure depends almost entirely on the temperature, and so the maximum comes at about 2 P.M. and the minimum around sunrise.

In the annual period the relative humidity is usually highest with the lowest temperature; but the vapor pressure varies directly with the annual temperature changes. The vapor pressure is 2 to 4 times as great in summer as in winter in most of the United States. The distribution of relative humidity depends, (1) on the temperature of the air, (2) on the proximity of the main source of moisture, (3) on the prevailing wind direction, and (4) on the topography to windward. East of the Rockies, April is generally the month of lowest relative humidity; while west, the mid-summer months are driest. In most of the United States, the highest relative humidity comes in the colder months, except in the southeast where it may occur in late summer or early fall. The lowest relative humidities occur in the far southwest, and in the lee of high mountains elsewhere, while the highest occur near the oceans, similarly, on the lee shores of the Great Lakes, and on the windward sides of mountains. On Pikes Peak and Mount Washington the humidities are generally high and show little variation. In the western half of the country the record minima range from 2 to 10 per cent., while in the eastern half, the lowest are 10 to 20 per cent.

Since absolute humidity is controlled by temperature more than by any other factor for most of the country, the lowest vapor pressure comes in winter, and is experienced

[4] *Monthly Weather Review*, Suppl. No. 6, 1917, 61 pp. (mostly tables), 34 charts. *Cf.* review in *Geogr. Rev.*, February, 1918, Vol. 5, pp. 155–156.

[5] *Monthly Weather Review*, July and October, 1919, Vol. 47, pp. 466–468, 710, 2 figs.

in the coldest part of the United States. In summer, the lowest is in the lee of the Sierra Nevadas. It is rather surprising to learn that the July vapor pressures about Yuma-Arizona, in almost the hottest and driest part of the Arizona desert are as high as those about the cool Great Lakes. Nothing could emphasize more strongly the fact that we feel in terms of relative humidity rather than in terms of absolute humidity.

In all the humidity tables and maps of Mr. Day's contribution we see a complex weather element which depends on the two variables, temperature and moisture. Humidity maps are in this respect on a par with snowfall maps; but they are less complex than those of evaporation, in which wind enters as another factor.

CHARLES F. BROOKS

SPECIAL ARTICLES

LIMITS OF THE GENERA VANDELLIA AND URINOPHILUS

MY monograph on the Pygidiidæ was published September, 1918. I was not able to state the limits of the genus *Vandellia* nor to indicate the type of the genus *Urinophilus*. These minute fishes are found in the tropical lowlands of South America. They attach themselves to other animals and drink the blood. Some of them are said to enter the urethra of bathers, and being provided with erectile, retrorse spines on the opercles can not be withdrawn. If not excised they finally enter the bladder and cause death.

It was found during the preparation of the monograph that some of the species contain teeth on the mandibles, others not. It was not known whether the type specimen of the genus *Vandellia* contained mandibulary teeth or not. The specimens are in the Jardin des Plantes, Paris, and were not accessible during the war. Dr. J. Pellegrin has recently examined these specimens and reports that the types of *Vandellia cirrhosa* Cuv. & Val. and of *V. Wieneri* do not have mandibulary teeth and the name *Vandellia* may, therefore, be restricted to those species without mandibulary teeth, *cirrhosa, plazai, wieneri* and *hasemani*. The name *Urinophilus* becomes, thereby, restricted to the only known species with teeth on the tips of the mandibular rami, *Urinophilus sanguineus* (E.). The species *Urinophilus sanguineus* is known from one specimen, 62 mm. collected by Mr. Haseman at San Antonio de Rio Madeiro, Brazil. Its alimentary canal was gorged with blood.

The genera *Vandellia* and *Urinophilus* are members of the Pygidiidæ, a family of the Nematognathi, the cat-fish-like fishes. In most of these the maxillary is reduced to a rudiment forming the base of the chief barbel of the catfish. In *Urinophilus* and *Vandellia* the maxillary bone carries peculiar claw-like teeth. In the monograph mentioned above the tooth-bearing maxillary was labelled "premaxillary" in the explanation of Figs. 35 *A* and *B*, and in Fig. 37.

C. H. EIGENMANN

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION H—ANTHROPOLOGY AND PSYCHOLOGY. II

Racial differences in mental fatigue: T. R. GARTH. An experiment was given to school children of three races—white, Indian and negro, involving a simple task which all could perform. The problem was to ascertain which race showed least falling away in a task of continuous performance. The young group worked for twenty-eight minutes and the older group for forty-two minutes. The Indians, as a group, excel the whites in endurance but not in total performance.

Supernormal memory: P. F. SWINDLE. Ordinarily, the term *hysteria* is a name applied to certain spectacular forms of behavior which arise quite suddenly and which consist of strong and very permanently associated responses. Such a form of behavior may be called a somnambulism, a fugue, a hysterical fit, or a special personality; and it is manifested only by those persons in whom associations are easily and at the same time quite permanently formed. If, in this sense, a person possesses an exceptionally good memory, a single unusual occurrence will probably suffice to establish in him a series of strong responses which will be manifested later as a somnambulism. It is profitable to speak of "big" somnambulisms and "little" somnambulisms, or spectacular somnambulisms and ordinary somnambulisms. Hysteria is